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## Collaboration opportunities in advanced housing renovation

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### Abstract

In theory, there is huge potential for reducing the energy consumed by existing single-family houses by thoroughly renovating them. For the successful market development of highly energy-efficient integrated renovations, supply chain collaboration is very important, while at the same time customer demand for integrated renovations has to be stimulated. A research and networking methodology was developed within the framework of the One Stop Shop project to identify and develop collaboration opportunities for advanced housing renovation in Belgium, Denmark, Finland and Norway. The research identified key supply-side needs through interviews and questionnaires, and analysed important elements for the development of a web-based portal that can connect supply and demand. The project further developed ideas and methods for collaboration and business model generation between different players on the renovation market. These different research results contributed to defining new business opportunities related to process innovation to unburden the homeowner and to achieve less fragmented renovation processes.

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## 1. Introduction

Today's new-build housing market focuses on higher energy performances. While a market niche is emerging for highly energy-efficient new-built houses – such as passive houses – improving the existing building stock is proving more difficult. For renovations to remain competitive with future new-build houses, the awareness is growing that renovation work will need to go beyond implementing single energy-saving measures and towards integrated energy renovations. There is huge potential to reduce the energy consumed by the existing building stock, especially when the aim is high energy efficiency in individual integrated renovation, but in most countries this issue is still mainly being dealt with at the demonstration project level [1]. But how do we make the leap from demonstration projects to a volume market for this kind of energy renovations? This subject has been dealt with in different IEA SHC Tasks, for example, resulting in reports such as “Business Opportunities in Sustainable Housing” [1] and, for advanced housing renovation: “From Demonstration Project to Volume Market” [2]. While these reports provide useful reflections and define key actors, innovation phases and exemplary processes, an important challenge remains to shape (regional) integrated supply and customer demand to increase the number of such renovations taking place effectively. To develop the market successfully, it will be necessary for different actors to cooperate to stimulate supply and demand.

To provide a better understanding of what drives the market development for advanced housing renovation, follow-up research activities were designed, such as the international research project “One Stop Shop. From demonstration projects towards volume market: Innovations for sustainable renovation”, [3] which was set up under the European ERA-NET Eracobuild programme and involves researchers from Belgium, Denmark, Finland, and Norway. The overall aim of this “One Stop Shop” project was to facilitate the development of (mainly owner-occupied) whole house renovations for the volume market. The project focused on renovating single-family houses to a very high energy standard while providing superior comfort and sustainability for occupants. As a starting point for the research, the situation in Flanders, Belgium, was taken to reflect on.

## 2. Research approach

The research in the One Stop Shop project gathered together and structured previously fragmented information on building stock analyses and demonstration projects in Belgium, Denmark, Finland and Norway (see [3] for national descriptions). Further technological innovations for housing renovation were listed in a catalogue (see [3]), and demonstration projects and experiences of related market actors were examined in detail. This research found that particularly systemic and architectural innovation and supply side collaborations between SMEs (small and medium-sized enterprises) are needed in order to achieve a higher standard of integrated energy renovations and integrate the technological innovations into daily practice. Research was therefore set up to identify the supply-side needs for systematic collaboration between different market actors. Research strategies were also developed to detect supply chain collaboration opportunities for advanced housing renovation, while at the same time reflecting on how to stimulate customer demand for energy-saving renovations. During this process, we hoped to initiate some innovation in the sector, particularly web-based developments, to reduce the burden on homeowners and achieve a less fragmented single-family housing renovation processes.

In this paper, the results from three research approaches within the One Stop Shop project, are presented.

The first research approach specifically aimed to detect key supply-side concerns regarding the need for a One Stop Shop for renovation work on single-family housing, as observed by supply-side actors in Belgium. Experiences from Belgian demonstration projects were collected during interviews with key

stakeholders (architects, homeowners, contractors) and a questionnaire was sent out to actors on the supply side. This information was used to provide input for a model that can be used to develop a web-based portal that links innovations on the supply side with potential customers.

The second research approach focused on analysing the strengths and weaknesses of the different existing web portals. This led to recommendations for a new web-based portal on how to better connect the supply side with the demand side.

The third research approach was designed to identify business opportunities through collaboration between different supply-side actors, and potential clients. After developing an actor categorisation in each partner country, a networking event produced additional research results.

### 3. Key concerns on the supply side

An initial step in supporting the supply side is to describe existing opportunities and key concerns. This was done using two parallel approaches. Firstly, experience from model projects in Belgium were used to identify difficulties and bottlenecks in real-life cases. Secondly, a questionnaire was used to record the ideas of all supply-side actors, even those without actual experience on very ambitious projects. The experiences of Belgian model renovation projects have been described in a separate paper [4]. Here we present the following general observation from this part of the research.

We detected a possible reduction in energy use of about four to ten after renovation, depending on the building typologies. Reaching the ‘passive house’ goal (space heating demand of 15 kWh/m<sup>2</sup>a) was found in practice to be quite a challenge for architects and homeowners, and in practice many major renovations ended up with a space heating demand of about 25-30 kWh/m<sup>2</sup>a after renovation. If the energy reduction target was set clearly from the beginning, it was more likely that the renovation would achieve better end results.

Demonstration projects illustrated several technological innovations – including combined technologies and even passive house concepts. It was also shown that increased speed, cost guarantee, low hindrance and an energy performance guarantee for the final renovation all provide innovation opportunities to respond to customer demand better. Innovation in integrated energy renovations is socio-technological in nature and the social component is currently often neglected. Quicker high-quality renovations with fewer technical compromises and energy performance guarantees are in demand from homeowners.

Interviewees saw the following issues as particularly problematic, requiring process solutions where another actor might play a role:

- Many traditional craftsmen are unfamiliar with the latest innovations;
- Many craftsmen are not used to working together on whole building solutions;
- Many craftsmen are involved, often resulting in problematic coordination on site which can result in lower quality and unclear lines of command and responsibility;
- The effort required from and disruption caused for occupants and owners should be reduced.

To overcome these socio-technical barriers, one option would be to improve the level of knowledge of the craftsmen. Another option might be to involve an additional actor with expertise of how to integrate innovative technologies to provide reliable information and play a coordinating role. The systemic use of innovative whole building concepts should be considered, since this can lead to well-coordinated renovation modules with fewer separate companies involved. Finally, it was observed that homeowners would like one single responsible person and a “One Stop Shop” solution in order to reduce the burden before and during the renovation.

Regarding the questionnaire, a survey was issued within the construction sector to consider the viewpoint of the companies involved and the willingness to cooperate with such a “One Stop Shop” idea.

It was sent to selected categories of professional members of VCB, PHP and BBRI, thus giving a broad perspective from the regional housing construction sector in Flanders. We received a total of 139 completed surveys; almost 70% of them from companies with less than five employees.

About one third of the respondents claimed that they already provided highly energy-efficient renovations that were frequently demanded. The share of such renovations within companies' turnover is still small to average. Respondents stated that they expected a large increase in this market within the next five years.

Table 1 shows some results regarding preferences for construction chain collaboration. It shows that each type of company is most willing to cooperate with a company within the same sector. For example, about 26% of all companies involved in structural works prefer an alliance with other companies in the same sector. Another 26% have no interest in working together at all. Sharing ideas or teaming up with companies in other sectors is only a second preference. Installation companies offering building services appear most willing to cooperate. Only 17% of them show no interest where as 83% would like to join forces. Companies that already renovate full buildings have the least interest in collaboration.

Table 1. Preferences for collaboration: enterprise activity versus preferred partner activity.

Enterprise activity/ preferred alliance	Structural works	Installation	Finishing	Design	Not interested
Structural works	26.32%	10.53%	10.53%	26.32%	26.32%
Installation	11.11%	41.67%	2.78%	27.78%	16.67%
Finishing	5.88%	11.76%	44.12%	17.65%	20.59%
Full buildings	8.33%	8.33%	25.00%	25.00%	33.33%
Others	10.00%	20.00%	20.00%	30.00%	20.00%

Aside from peer-to-peer contacts, most professionals prefer the designer as a second option for collaboration: the designer is second for a preferred alliance for all groups. More in detail, when asked what exactly the respondents meant by “a designer”, up to 54% chose an architect. Another 32% opted for a guiding engineer. We can only speculate whether these companies were in fact just looking for a coordinator to supervise the whole project. Another possible explanation can be found in discussions on responsibility. With the presence of an architect, responsibility can be shifted. Obviously, we can also mention the reservations of some companies about the efficiency and transparency of such cooperation. A badly organised alliance could, in the worst case, even work counterproductively and create additional problems.

Most of the participants in the questionnaire were micro-enterprises, which reflects the fact that most of the enterprises in the Belgian renovation market are small or micro-enterprises. To develop the One Stop Shop idea further, we concluded that it would probably be best to concentrate on companies who are active in the finishing and/or technical issues within the regional housing market. Many of these companies are very much aware of the trend towards highly energy-efficient renovation and expect a share in this market development. A general contractor, on the other hand, may have more experience in different activities and be better placed to carry out their own coordination, which could reduce the need for cooperation with other enterprises.

We observed that most companies wanted some form of collaboration. Their preference for cooperating within their own field of activity or with an architect could have important implications for the diffusion of knowledge, skills and innovations: it implies a preference for peer-to-peer education and

stronger collaboration with the architect. The physical clustering of SMEs was not a popular option, and we can only speculate about whether companies are unfamiliar with this idea. On the other hand, professionals did expect awareness to increase through education and knowledge transfer. They recognised the value of seminars, workshops and a website for knowledge transfer. They also appreciated specific project information, listing of market players, better information on technical innovations and improving quality and cost control.

Regarding the preferences of the respondents, the concept of a web platform was considered as a source for the One Stop Shop, where possible techniques and innovations could be assembled with links to while coupling seminars and workshops, project brochures, listing market players, and so on. The questionnaire also confirmed the importance of linking this website with the demand side: the homeowner also needs to be able to access information, which was perceived by the supply side as a most important barrier. It can thus be imagined that such a website could even serve as a portal for the customer to gain knowledge about several firms.

#### **4. Research on web-based portals**

Following up on the results of the questionnaire, we looked more closely at what a website for knowledge transfer between the supply side and the demand side could look like. We investigated already existing web platforms with the goal of providing a better understanding on how homeowners' innovation-decisions can be steered. This research was presented and discussed in a separate paper [5]. Some of the opportunities identified are presented below.

The use of innovation-decision models can significantly contribute to a better understanding of what drives decision processes in both customers and SMEs to adopt innovation and how this relates to possible solutions in order to increase the uptake of highly energy-efficient renovation. In this research we focused on research methods regarding the diffusion of innovations, as exemplified by the work of Rogers [6]. According to Rogers' concept of innovation-decision processes, communication channels can influence each step of the decision-making process. Rogers divided these steps in the innovation-decision process into five levels: first knowledge of an innovation; second forming an attitude towards the innovation; third making a decision to adopt or reject it; fourth implementing the new idea; and fifth confirmation of this decision. In each step of the decision process potential adopters can decide to give up on the innovation, so communication channels need to provide the right information at each step and guide the potential adopter through the whole process.

We found twenty existing web platforms in seven countries providing a housing renovation oriented portal aimed at suppliers and homeowners. By comparing these websites, we detected that different actors could lead such websites: public actors, vendors, consumer organisations, non-profit organisations, architect organisations, contractor federations, and so on. The content of the existing websites was found to vary from simple text communication and selection tools to multi-level interfaces or user toolkits where the customer can manipulate the final product or desired outcome.

In order to analyse the websites' strengths and weaknesses systematically, five levels of information were defined, as illustrated in Table 2, according to Rogers' concept of innovation-decision processes. Table 2 gives an idea of the questions that the homeowners would expect to be answered from a web platform in order to guide them from one level to the next.

Table 2. Guiding questions that homeowners would expect to be addressed on a web platform, in order to guide them through each step of the innovation-decision to adopt thorough renovation

Step of the innovation-decision	Guiding questions that homeowners would expect to be solved from a web platform to adopt thorough renovation
1. Knowledge	What counts as thorough renovation?  What solutions are available? (concepts, technologies, innovation)
2. Persuasion	Why should I undertake a thorough renovation? (long-term savings, ecological motivation, energy savings, avoiding future works or long-term renovation, combining different grants and tax benefits, and so on)  Why should I choose a thorough renovation compared to what I had in mind? (awareness-raising based on own situation: kitchen/bathroom renovation, desire for extension, improvement of comfort or air quality of certain rooms, improving downgrading roof or façade, ...)  What are the experiences of other homeowners that chose thorough renovation? (process, actors, cost-benefit, achieved quality)
3. Decision	Where can I ask for price quotations? (suppliers, financing, consultants)  How can I compare, choose, reject offers? For example, what needs to be specified in a contract proposal?
4. Implementation	How should I plan the intervention of actors?  What questions do I have to ask during the works to check the quality?
5. Confirmation	How do I get a guarantee/ recognition/ label of good execution/ energy performance?  How can I express positive/negative experiences?

## 5. Research on actor collaboration

The next step in researching actor collaboration was to determine which supply-side actors need to collaborate. As part of further research, we identified important actors regarding supply chain collaboration in four different countries (Belgium, Denmark, Finland and Norway). As such we aimed to learn which actors need to cooperate and who plays what role in the innovation adoption process. For this reason, we continued the logic of Rogers' innovation adoption process when categorising actors and defined actors for each country in actor categories as: informing, convincing, deciding, implementing, and/or confirming.

- Informing actors (information).

A very large group of possible actors in each country can be found in the informing branch. This role can be fulfilled by federations, policy supporting actors, non-profit organisations, research organisations, energy distribution net managers, manufacturers of products, and so on.

- Convincing actors (persuasion).

In all country reports, persuasion was related to financial support, since this encourages homeowners to choose thorough renovation. Persuading actors are therefore mostly those actors that provide financial support, such as governments, banks or energy distribution companies.

- Responsible actors (decision-makers).

Practically, thorough renovation needs strong coordination and well-informed decision-making. We found that in the partner countries for the market of owner-occupied single-family houses, owner-occupiers are still often responsible for their choices despite having very limited knowledge of the

technical issues involved in innovations. The decisions made by the homeowners depend heavily on the advisor they choose. Occasionally, an advisor such as an architect takes over (part of) the decision process. A number of different actors were identified who provide such guidance on the subject of renovation. In the case of minor renovation work, the homeowner will rarely hire a consultant, but instead make a decision based on the advice of the contractors or craftsmen hired to carry out the renovation. In case of thorough renovation work, we found that the homeowner may hire an energy consultant to help guide the process and make the right decisions. Energy consultants were engineers, architects, turnkey suppliers or building contractors, for example. Advanced energy performance certificate advisors do not currently act as responsible actors, although such opportunities were detected in Belgium. In Norway, emerging opportunities were detected for project managers as the decision-making actors were working directly for homeowners.

- Implementing actors (implementation).

In order for an energy renovation to be effective, it is important that solutions are implemented appropriately. Although many SMEs claim to have some experience with thorough renovation, the previous questionnaire established that individual craftsmen still need to be educated on the specifics of deep renovation. There is shortage of training courses on this subject. However, all the countries studied have course material available that can be developed further in order to obtain more expertise in this field. One course of action to support the supply side would be to install a course on the specific topic of the project management of integrated renovations.

- Quality-assurance actors (confirmation).

The limited knowledge of implementing actors and the issue of consumer trust led to some concerns about processes in which actors collaborate. Thorough renovations were perceived to need some form of quality assurance. Energy performance guarantees, avoiding thermal bridges and achieving high airtightness are particularly important. In the partner countries, there is currently no general use of a specific quality assurance mechanism for integrated energy renovations. All countries rely on the applicable legal warranty period. To some extent, different voluntary labels are available in different countries. For example, the Belgian Passive House Platform offers a passive house certificate for renovated housing.

Further research focused on exploring opportunities for collaboration between actors from different categories as explained above. As part of the One Stop Shop project, a specific networking methodology was developed which involved clustering innovative players to detect novel business models and reduce the fragmentation of the renovation process for single-family houses. A unique international business networking event was developed, entitled "Business Zoo", and was first held in Antwerp, Belgium on 18 April 2012 [7]. This event aimed to inspire actors regarding novel forms of collaboration in the renovation chain in order to realise integrated sustainable housing renovation, using elevator pitches and problem discussions in small groups.

In group discussions, the participants were grouped into the actor categories mentioned above using animal pictograms, and were asked to brainstorm on renovating a particular house. In this exercise, the homeowner was given a central role in enforcing strict and ambitious demands, so that the supply side actors were forced to think from the client's perspective. We used a predefined 'animal gathering' canvas (see Figure 1) to facilitate this process. At the end of the day, the participants were urged to take up the challenge of developing new business models, expanding the previous case development to the volume market. Different groups developed specific integrated business models for deep and sustainable renovation, using a business model generation canvas (see Figure 2).





Fig. 1. Impression from the Business Zoo workshop (animal gathering canvas development).

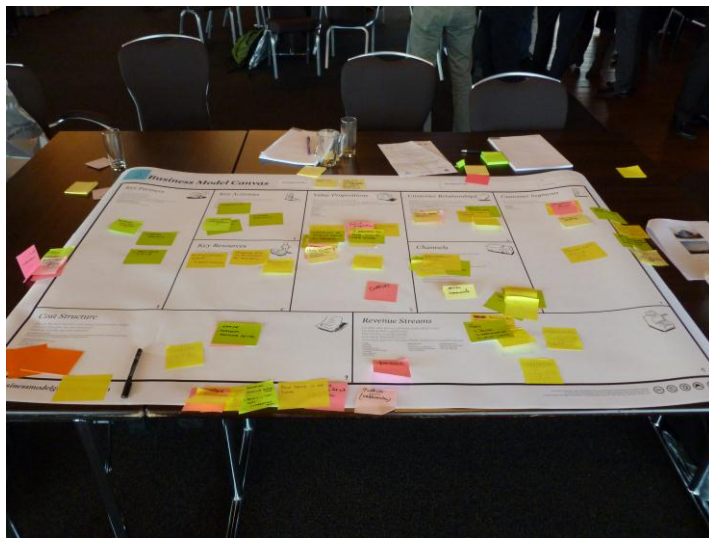


Fig. 2. Impression from the Business Zoo workshop (business model canvas development).

The "Business Zoo" methodology – a new method of networking – allowed different market players to identify collaboration opportunities with potential national and international partners. The questions addressed during the networking event included various important issues such as how to make the cost of renovation fully transparent, how to speed up the renovation of large stocks of post-war housing with faster construction methods, how to adapt energy performance certificates – and energy performance advisors – for integrated renovations, and so on. Furthermore, new business opportunities were explored resulting in the development of a fictitious business model for collaboration between different renovation

market players, such as architects, contractors, project managers, suppliers, do-it-yourself stores, owners, financiers, city councils and communities, and so on.

During the event, we detected that substantial innovation was still needed on the supply side, especially regarding collaboration between different craftsmen and experts. In the growing market for deep renovation, homeowners can no longer be expected to coordinate the whole renovation process, to find all the information concerning deep renovation solutions and examples, to contact, contract and coordinate a range of individual craftsmen, to ensure quality while keeping costs and energy performance under control, and all the while managing the administrative burden and the uncertainty over financing the whole project. In order to prepare for a growing market, companies must be aware that the homeowners expect one single point of contact to take responsibility, act as project manager, and ensure quality and efficient, rapid execution.

More detailed results from this research will be described in a separate paper, which will be made available on the One Stop Shop website [3]. The business development opportunities identified provide a valuable insight into how market player's responsibilities and tasks might change in the near future and under which conditions companies would like to collaborate in a business development.

## 6. Conclusion

The current fragmentation – separate SMEs each doing a fraction of a supposedly integrated renovation – cost escalation, lack of knowledge and lack of project management are very important barriers to the advanced energy renovation of single-family housing. However, many companies are willing to collaborate and expect their share of this market segment to grow. Our research has found that renovation processes need to be reformulated and better collaboration structures need to be developed to unburden the client. In order to respond better to the supply-side concerns identified, both supply- and demand-side actors need to be informed in a more targeted way. A 'One Stop Shop' web portal could both inform actors, as well as reducing the burden on homeowners. To model such a web portal, we applied Rogers' innovation diffusion theory. The five steps in innovation-decision processes (information, persuasion, decision, implementation, confirmation) provided an interesting basis for the further development of a communication model that integrates opportunities from both the perspective of both the supply- and the demand sides.

We also related different actor categories to the homeowners' innovation-decision phase in the partner countries (Belgium, Norway, Denmark, Finland) and identified a common need to develop a pool of experienced actors for implementation and quality-assurance, as well as a need for support schemes for thorough renovation. Collaboration by different actor categories would support the market development that is needed, as well as the development of a web platform. A particular challenge is to increase the flow of technical information on thorough renovation that is required, as well as project management knowledge, from the many informing actors to the many less experienced implementing actors, which are mostly SMEs.

We also gained further insights when networking different actor categories. In the single-family housing renovation market, it appears that market-proof solutions are needed when it comes to alleviating financial burdens and project management. Ideally, innovators would jump into this gap in the market and set themselves up as project coordinators who can support the homeowner throughout the decision-making process.

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